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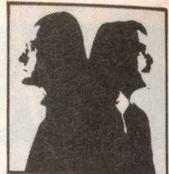
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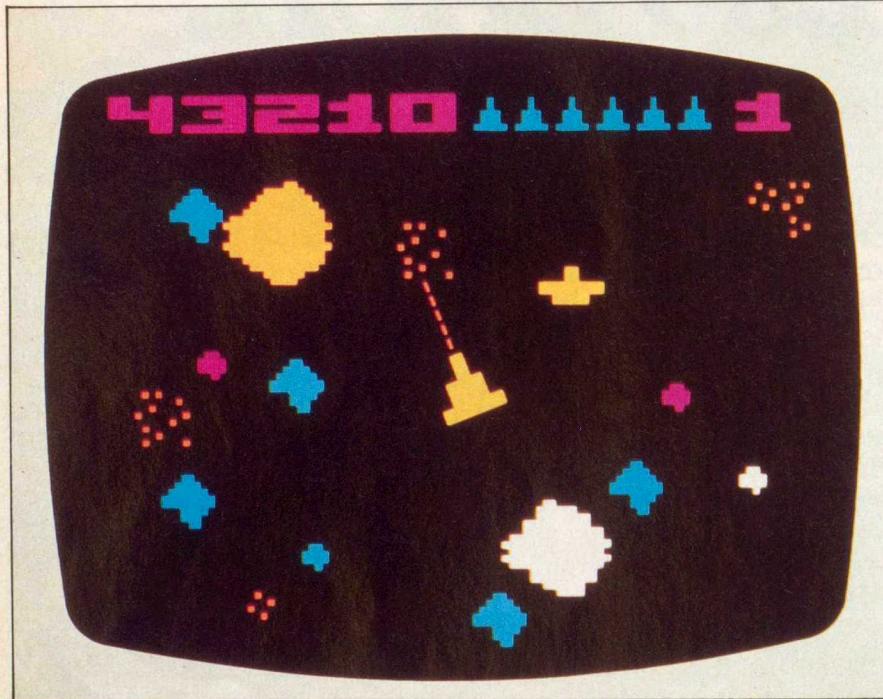
Arcade Alley

A Critical Look at Video Cartridge Games & Programs

by Bill Kunkel & Frank Laney, Jr.



The Third Annual Arcade Awards



'Asteroids,' VIDEO's Game of the Year, is loaded with intriguing options, including fast and slow space rocks, hyperspace, and shields, all in color.

Any discussion of the video-gaming year just ended is bound to run out of superlatives in short order. It was that kind of year. Never before has the electronic-arcade field witnessed so many technological and design breakthroughs. And the flood of new cartridges introduced for all major programmable video-game systems is similarly without parallel in the hobby's brief history.

That's certainly delightful news for the millions of Americans who now own and play these games, but it does create some problems when it comes to the 1982 Arcade Awards ("Arkies"). This is the third year that VIDEO — this time joined by its new stablemate *Electronic Games* — has sponsored these awards to honor excellence in the electronic-gaming field, and the competition for the 13 Arkies proved unbelievably intense. There were two, three, or even more worthy candidates in every category, and a few titles that might have walked off with the honors last year didn't cop even an honorable mention. The plethora of outstanding new games is the best thing that could've happened to electronic arcading. It shows that

the manufacturers, far from resting on their laurels, are continuing to innovate and explore.

Before proceeding to the awards, let's run through the ground rules. Games introduced into national distribution during 1981 are eligible, except for a few 11th-hour entries that will be held over for consideration next year. No one title can be awarded more than one Arkie, although multiple honorable mentions are possible. Note that this year, for the first time, there are four Arcade Awards for the best in computer gaming. All right now, let's break out the prizes!

• Video Game of the Year: **Asteroids** (Atari).

The most anxiously anticipated video game of all time proved to be well worth the wait. Atari's VCS version of its coin-operated smash is both a magnificent game and a technological achievement of the first order. After prototype versions of "Asteroids" drew negative response, the sorcerers of Sunnyvale reworked the whole thing, developing a special process that "fools" the VCS console into reading programs twice as long as what was pre-

viously thought possible.

The result is a cartridge loaded with intriguing options. Both hyperspace (from the coin-op original) and shields (introduced on "Deluxe Asteroids" in commercial arcades in 1981) are offered, and there is a choice of either fast or slow space rocks. In the excellent fast mode the asteroids respond to the player's fire. When the ship shoots an asteroid from the left side, for example, the fragments spin off toward the right. This creates a cosmos of wildly drifting space debris that closes on the gamer's ship from every conceivable direction.

The VCS cartridge even adds color to the game, an element missing from the commercial-arcade quarter-snatcher. The package is further enhanced by the most distinctive sound effects this side of "Space Invaders." "Asteroids" is a masterpiece. Honorable Mentions: **Quest for the Rings** (Odyssey), **UFO** (Odyssey), and **Missile Command** (Atari).

• Most Innovative Game: **Quest for the Rings** (Odyssey).

Even in a year distinguished by so much ingenuity, "Quest for the Rings" stands out like Charlene Tilton at a spinster's convention. Odyssey designers have charted a bold new path for video games by blending on-screen action with aspects of the traditional board game. The brilliant synthesis enriches "Quest" with more depth, detail, and complexity than any previous cartridge for this or any other programmable video-game system. This is the first of a projected series, and it has set an enviable standard of excellence for the titles to follow.

Fighting the forces of eldritch evil is the theme of "Quest for the Rings." Two players each choose one of four different characters and work cooperatively to find and capture the mystic rings hidden beneath the various castles shown on a colorful mapboard provided with the cartridge. A unique feature is that the location of the treasures and monsters is completely programmable before the start of each game. Every element of "Quest" is absolutely first-rate from the animation of the various creatures to the clean rules. "Quest for the Rings" is not only marvelously innovative, it is an outstanding video game. Honorable Mentions: **Freeway** (Activision) and **Asteroids** (Atari).

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Arcade Alley

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- Best Competitive Game: **Tennis** (Activision).

Al Miller's "Tennis" is as far removed from the primitive "Pong"-style games from which it derives as gasoline is from the dinosaurs. The trapezoidal court furnishes a realistic illusion of depth while allowing arcaders complete freedom in positioning their electronic racketeers. Played at either skill level, "Tennis" is nearly always a hard-fought contest in which glorious comebacks from the brink of defeat can and do happen. Accurate aim counts much more than fast reflexes, giving more methodical players a chance to taste victory against the kings and queens of hand-eye coordination. Honorable Mentions: **Ice Hockey** (Mattel) and **Warlords** (Atari).

- Best Solitaire Game: **Missile Command** (Atari).

As with all the great single-player contests, "Missile Command" delights the senses and challenges the reflexes. Vivid graphics including a color-changing background help maintain involvement in this struggle to defend six Earth cities against a rocket attack from space. Atari introduced a new approach to game variations in this cartridge. Instead of offering different play options, each variant slightly increases the speed of the attacking missiles and therefore the difficulty of the game. Thus it is possible for the solo aracker to precisely tune "Missile Command" to an appropriate skill level every time. There's even a super-easy version for young kids so they won't get left out of the fun. Honorable Mention: **Dodge 'Em** (Atari).

- Best Science Fiction Game: **UFO** (Odyssey).

Odyssey designers have always had a special affinity for science-fiction themes, and this cartridge is definitely one of their greatest triumphs. Arcaders maneuver a Federation flying saucer around a playing field clogged with three distinct types of unidentified flying objects. Many just drift aimlessly through the void, but some home in on the aracker's craft and a few actually fire deadly laser weapons. Fast action is the hallmark of "UFO." It's a rare gamer who can keep the spaceship from disintegration for more than a few minutes. Honorable Mention: **Laser Blast** (Activision).

- Best Sports Game: **USAC Auto Racing** (Mattel).

This is the racing game even those who hate motor sports ought to love. Forget about the boring time you had steering car-shaped blips around a simple oval, this is true blood-and-thunder racing. Drivers choose from a selection of vehi-

cles with different acceleration, cornering, braking, and speed characteristics and guide them around a variety of beautifully rendered courses. Although "Auto Racing" is a solid competitive game, it shines especially brightly as a solo contest. Multi-lap races against the clock are fast, thrilling, and thoroughly enjoyable. Honorable Mentions: **Championship Soccer** (Atari) and **Tennis** (Activision).

- Best "Pong" Variant: **Warlords** (Atari).

Here's something really new and different in "Pong"-style designs. "Warlords" blends elements from "Breakout" with the more traditional ball-and-paddle games to produce a cartridge that delivers plenty of on-screen excitement for up to four gamers. The cartridge employs a medieval setting as a basis of a four-way free-for-all as players attempt to batter down the walls of their opponents' castles and slay the monarchs inside. Being the last surviving warlord earns gamers a point, and winning five such battles wins an overall victory. Honorable Mentions: **Blockout/Breakdown** (Odyssey) and **Whizball** (Zircon).

- Best Audio-Visual Effects: **Kaboom!** (Activision).

The world's only video-game software company, well-known for the beautiful simplicity of its graphics, hit the mark dead-center again with "Kaboom!" From the smirk on the mad bomber's face when he gets one past the aracker to the sinister hiss of the incendiary devices he lobbs over the wall, this Arkie winner is a feast for the ears and eyes. The game concept is not startlingly new—the coin-op favorite "Avanche" is similar—but the whole thing is carried off with such elan that "Kaboom!" has become an instant classic. Honorable Mention: **Quest for the Rings** (Odyssey).

- Best Commercial Arcade Game: **Pac Man** (Namco/Midway).

Only moderately successful when first introduced, "Pac Man" caught fire last summer. It has zoomed to the top of the popularity charts and several home versions are already climbing up the best-seller lists with more on the way. Created by Japan-based Namco, which gave arcaders "Galaxian" in 1980, "Pac Man" gobble up quarters under the Midway banner in this country.

"Pac Man" is an offbeat hit—it has no aliens, explosions, or multiple playfield changes like most other popular machines. What it does possess is a fascinating game concept, charming graphics, and a curiously strong appeal to female arcaders. Honorable Mentions: **Battle Zone** (Atari) and **Defender** (Williams).

- Computer Game of the Year: **Star Raiders** (Atari).

No question about it, "Star Raiders" is easily the most dominant piece of game software extant. This space-war simulation blends strategic and tactical modes into a masterful brew that's as close as

we'll ever get to blasting into space to save the universe. An arcading epic, "Star Raiders" embodies state-of-the-art design that lifts it above the hundreds of excellent computer games released during 1981. It conclusively refutes the idea that a richly complex game must compensate by being visually dull. "Star Raiders" treats gamers to both pulse-pounding action and all the bells and whistles anyone could desire.

- Best Computer-Action Game: **Jawbreaker** (On-Line).

This is a must for "Pac Man" fans lucky enough to own an Atari 400 or 800 computer. This time, the aracker steers a set of on-screen teeth through a candy store, gobbling the goodies and avoiding the bullies. Energizing jawbreakers are strategically spotted around the colorful store and, when eaten, allow the choppers to turn on the bullies and send them scurrying for cover. When every tasty morsel has been devoured a toothbrush enters the playfield, polishes the teeth, and readies things for another romp through candyland. And until you've heard the opening theme song, a computer version of "The Candy Man," you ain't heard nothin' yet.

- Best Computer Sports Game: **Computer Baseball** (Strategic Simulations).

Statistical-replay table sports games have enjoyed a large and enthusiastic following since the mid-1950s. Now Strategic Simulations has brought the concept to computer gaming in an attractive and easy-to-use form. Would-be Casey Stengels and Earl Weavers can choose from among 26 of the greatest teams of all time or make up their own all-star squads using the simple instructions provided with the game. "Computer Baseball" can be played by two, or the computer will be only too happy to direct the opposing nine in a solo contest. A well-executed on-screen diamond shows the positions of the fielders, indicates whether the batter is left- or right-handed, and displays the foot-speed of any base-runners.

- Best Computer Adventure: **Empire of the Over-Mind** (Avalon-Hill).

It took Avalon-Hill, the leading maker of adult-strategy games, a little while to get the hang of computers, but "Empire" shows the company is on the right track now. Although it superficially resembles earlier text adventures, "Empire of the Over-Mind" offers the game a breadth of options not found in the more linear contests in which obstacles must be overcome in more-or-less exact sequence. There's more than one way to vanquish the nefarious Over-Mind, which means that the game can still be enjoyed even after it is solved the first time.

This 40K program, available for most of the popular microcomputers, is a journey into the land of imagination that should keep would-be heroes highly entertained for a month of play sessions.

Do you want a LaserVision player? And if so, do you want this one?

There's no question that as home-video systems go the LaserVision system offers more performance and more potential than either tape or CED discs. With CAV discs (see accompanying note), it offers the broadest array of special effects, it has the best picture, and it has the best sound. CED, however, costs less and offers a greater variety of program discs—important, because you cannot record programs on videodisc. (If disc systems with home-recording capability ever do arrive, though, they're more likely to be compatible with LaserVision than with CED or the forthcoming VHD system.)

If you want a LaserVision player, you have two choices so far: Magnavox and Pioneer. The Pioneer has visibly lower picture noise, random access to any frame or chapter on the disc (with CAV discs only), a more convenient remote control, and more conservative styling. The Magnavision 8005 costs less than the Pioneer VP-1000 with remote control, has a more convenient slow-motion adjustment, and has more futuristic styling. The VP-1000 without remote control is a few dollars lower than the 8005. But Magnavox's 8000, for which remote is not available, costs considerably less even than that.



Alphabet Soup

The LaserVision (LV) system includes two kinds of videodisc: Constant Angular Velocity (CAV) discs, which play for one half-hour per side or one hour total, and Constant Linear Velocity (CLV) discs, which play for an hour per side or two hours total.

Constant Angular Velocity translates into "turning at a constant speed in rpm"—1800 rpm, or 30 revolutions per minute. It's no coincidence that this corresponds with our TV frame rate of 30 frames per second. With one video frame per revolution, CAV discs allow easy still-framing with the system scanning the same frame over and over, not tracking on to the next frame. By changing the rate at which the laser head steps from one track to the next, pictures can be advanced frame by frame or played at normal, slow, or fast speeds or in high-speed Visual Search mode, all (except Fast Motion) in forward or reverse too. (It also helps that LV discs have no groove walls to be worn down as the head scans the same track repeatedly or traces its way backward between tracks.)

But the disc's outermost tracks have about two-and-a-half times the circumference of its innermost ones. It's wasteful to put only as much information into that larger track as the smaller one would hold. So Extended Play discs speed up as the track diameter increases to put about two-and-a-half times as much information into the outer track as into the inner one. The angular speed in rpm goes down, but the linear speed in inches of track passing the laser head per second remains constant—hence, Constant Linear Velocity. That cuts the cost of longer recordings and makes them more convenient to use—a two-hour movie now fits on one disc with only a single interruption in the middle. But eliminated are the Still Frame, Slow Motion, Reverse, and Fast Forward, allowing only normal Play and visible Fast Search.

Test Report: Magnavision 8005 LV Player, by Magnavox

DATA

Date of test: October 1981

Suggested retail price: \$769

Weight: 40 pounds approx.

Dimensions: 6.25 x 22.2 x 16.25 inches (h/w/d)

Power requirements: 120VAC, 60Hz, 80W

Disc format: LV (LaserVision)

Disc speeds: VAC (Constant Angular Velocity, 1800 rpm), half-hour per side; CLV (Constant Linear Velocity, 1800 to 600 rpm, variable), one hour per side

Play speed select: automatic

Play reverse: CAV only

Still frame: CAV only

Frame advance: CAV only

Slow motion: CAV only, continuously variable 1/120X to normal, forward and reverse, speed control and reverse not available on remote

Speed play: 3X, CAV only

Rapid search: 60X approx., CAV; 120X approx., CLV

Pause: none, in CAV use Still Frame

Fast forward/rewind: same as Rapid Search, 26 seconds at either speed

Remote: IR (infrared)—Play For., Play Rev., Fast Play, Slow For., Still Frame, Frame Advance For. and Rev., Index on/off, Search For.

and Rev., Audio I on/off, Audio II on/off (machine ignores irrelevant commands in CLV)

Separate eject: yes

Counter digits: on screen; frame number and chapter number (where used) in CAV, hours and minutes in CLV; controlled by Index button

Audio channels: 2 completely independent, switchable, may be used for bilingual playback

Random access by frame: no

Random access by chapter: no

Accessories: remote control, automatic antenna switch, antenna switch mounting hook, cables

RESULTS & RATINGS

Horizontal resolution: 330 lines

S/N ratio, video luminance: 43dB, measured; 42dB, rated

Audio frequency response: 40-20,000Hz, not measured, see text

S/N ratio, audio: 57dB, measured; 55dB, rated

Audio distortion: 2.2%, measured; 2%, rated

Overall picture quality: excellent

Audio quality: excellent

Ease of operation: excellent in some areas, only good in others, see text

Overall performance: excellent/very good



Radio Shack Computer



number 136

When we covered the Radio Shack TRS-80 Model I ("VideoTests," VIDEO, March 1980), it was one of the lowest-cost computers on the market at \$499, and 100,000 had been sold. Now over 200,000 have been sold and the Model I has given way to the new much-improved Model III version at \$699. The main reason for the Model I's replace-

ment was a simple one, and one that VIDEO readers will appreciate: to reduce TV and radio interference. That dictated the most obvious change in the system: the Model I—keyboard, memory, video display, and up to two floppy-disk drives—is completely contained in one box for easier shielding against RF interference, while the Model I occupied a minimum of three (keyboard, power supply, and monitor) and could spread into as many as seven (the above plus Expansion Interface, its power supply, and two floppy-disk drives for a two-disk system). The Model III's case is in the same silver-grey plastic and black trim as the Model I.

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index. You may find only a few brands to choose from. As long as you have a credibility index for two or three of the nationally distributed brands, you'll have a pretty wide number of choices open.

One other antenna factor deserves attention: directionality, the property that makes antennas more sensitive to signals from one direction. It helps the antenna reject unwanted signals. In TV, any signal not related to the channel you're watching or taping is noise. Therefore, the more directional the antenna, the less noisy the picture will be. As noted earlier, directionality can help reduce ghosts and you may want to get a larger antenna than necessary for its ghost rejection. You may have to drain off the excess signal with splitters or other attenuators so you won't overload the set.

Some manufacturers use diagrams to describe directionality. Others use two numbers to tell the story: front-to-back ratios and front-to-side ratios. These figures do not give as much information as the diagrams (polar plots) but are a lot better than guessing. The figures are in decibels. Remember that the larger the number in this case, the better the directionality.

Other things like antenna height, downleads, antenna amplifiers, splitters, combiners, and matching transformers all affect how much of the antenna's signal reaches the set. We'll talk about them in another article. We'll also add more information on multi-band antennas vs. single-band and single-channel ones. In the meantime, start gathering information on nearby stations and making up your local-credibility index. Get some of the people you ask for information to help. Everyone in the neighborhood can benefit—including you.



Radio Shack Computer

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We normally don't test self-contained computers like the Model III in VIDEO unless they have highly detailed color graphics; for the most part, we try to test computers that hook up to external TV sets or monitors. But there are several reasons why we make an exception of the III: it directly replaces the world's most popular computer, it does have some graphics capabilities, and it gives us a rare opportunity to do a long-term performance report because we've been using it steadily since February 1981. (Most of last year's Berger-Braithwaite reports were actually written on a Model III using Radio Shack's word-processing program, SCRIPSIT; the rest were written on a Model I using the same program.)

Options and Capabilities. The Model III is based on the popular Z-80 microprocessor chip, running at a clock frequency of 2.03 MHz, far below its maximum rated speed of four MHz but still noticeably faster than the clock speed

of a Model I. That means it runs reliably, with inexpensive memory chips, but not quite as quickly as it could.

The computer is available with a minimum of 4K bytes of memory. One "K" is a "binary thousand," actually equal to 1024; so 4K equals 4096. The maximum is 48K (49,152). Each "byte" can hold one character, one instruction, or a number up to 255. That 4K minimum sounds like a lot but is easily filled by even simple programs or limited amounts of data (this article, for instance, already occupies 2667 bytes). For that reason it's only available with Level I BASIC, a useful but limited language, at the computer's minimum \$699 price. Raising the memory to 16K with Level I BASIC raises the price another \$99; with 16K and Level III BASIC, it's \$999; with Level III and

48K, \$1197.

The Model I could only hold 16K of memory internally; to go beyond that (or to add a printer, disk drives, or an RS-232 serial interface to feed other computer devices) you had to add a \$299 Expansion Interface. This is not needed with the Model III, which makes its cost actually lower than a Model I with similar capabilities.

The Model III can be used with no knowledge of programming simply by buying and loading in programs on cassette or disk. But to take full advantage of its capabilities (and to have the most possible fun), you'll want to write some programs of your own. You can write them in BASIC, a simple programming language using English commands and statements. There are three versions of this BASIC available: Level I (substantially identical to the Model I's Level

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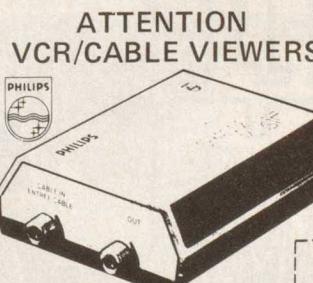
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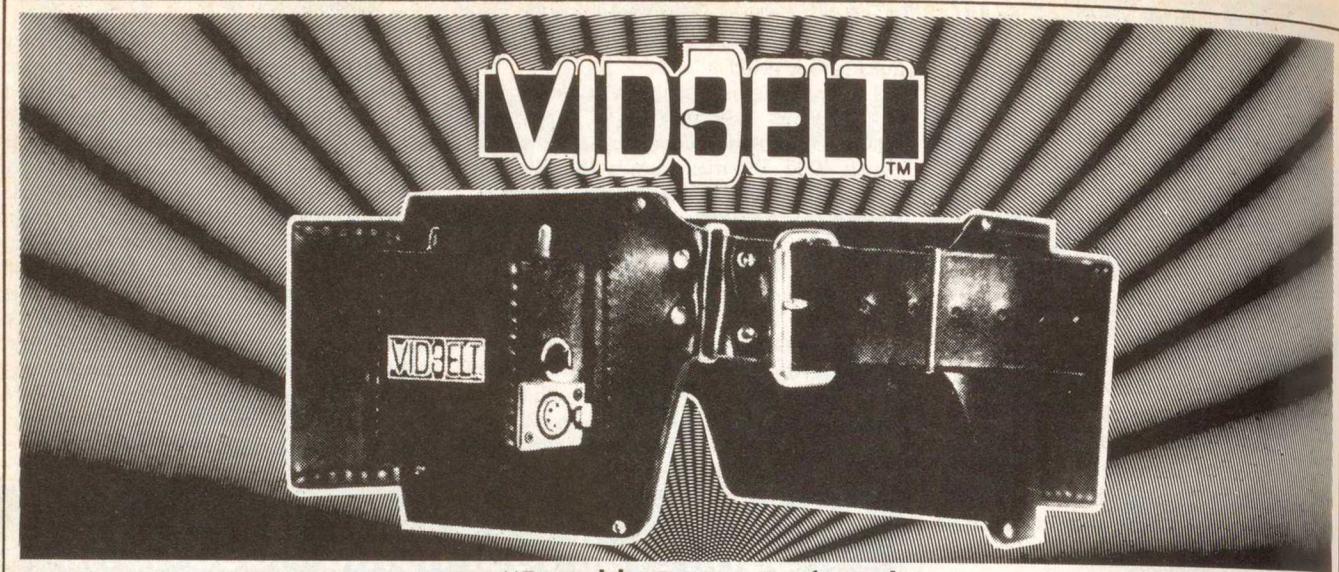
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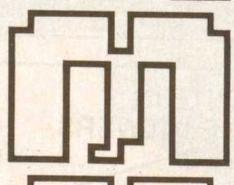
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I), Level III (with new capabilities not found in the Model I's Level II), and Disk BASIC (again with improvements over the earlier model's version). Levels I and III come on as soon as you turn on the computer; Disk BASIC has to be loaded on disk, which takes only a few seconds.

Level I BASIC has some math capability, some graphics capability, and some ability to handle "strings" such as words or sentences. Since the printer interface is now built into the computer, it has been given printer commands (not found in Model I BASIC). So you can list your programs on the printer—a major help in debugging programs too long to fit on the screen—and save the results of program runs on paper for later reference.

Level III, though, is the way to fly. It does everything the Model I's Level II BASIC did and then some: it runs 30 percent faster than Level I and can load and save cassettes up to three times faster. Even more significantly, it makes writing programs faster: you can edit program lines that contain errors, whereas Level I makes you rewrite the line from scratch with the possibility of new errors lurking in the wings. You can Trace program execution, getting a record of the steps the program went through, so you know how it jumped off its track. Level III automatically numbers program lines for you as you write them. And when you make programming errors, Level III is far more explicit than Level I in stating what they are.

With Level III you can use lower-case as well as the upper-case (capital) letters of Level I, and can display on screen a number of new characters, including Greek, Japanese, and other foreign characters, the four-card suits, smiling and frowning faces, a miniature man and woman, legal and mathematical symbols, and many more. Level III also has improved ability to handle strings, which means you can write far more elaborate and useful programs to communicate with users and interpret their input, and write graphics programs to draw images on screen more easily. Other features include automatic repeat (you hold down a key) and the ability to shift from normal screen format (16 lines of 64 characters) to a large-character format (16 lines of 32) for use when the screen must be read from a distance, for those with poor vision, or just for greater impact. Level III is also needed for use with the optional RS-232 serial port (\$99), used for communications with some printers and with other computers.

That's just a quick summary of the differences. To quantify the differences a bit, Level I takes up 4K of memory (not part of the 4K-48K RAM memory, most of which is available to the user) and requires a 236-page manual (not all of which is devoted to BASIC); Level III takes up 14K and has a 340-page manual (a fine one, too).

The Disk Option. If Level III is the way to fly, adding disk is like swapping your Piper Apache for a Lear jet. The cost is noticeably higher: \$849 for the first disk, \$399 for the second (plus installation if not ordered when you buy the machine), and \$499 for each of the last two drives (which plug in externally).

Disk drives hold more information than cassettes and make it more accessible. That means that you can switch programs in an instant (under half a minute, anyway)—handy if you're entertaining the kids on a rainy day. But it has wider implications: You can easily handle business programs which may need instant access to a record in the middle of a file (with cassette, you'd have to read the whole file till you found it). And you can run more elaborate

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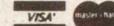
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programs too large to fit into your memory at once because only the part you're currently using need occupy memory at any time; the other parts can instead come in from disk when needed.

Disk BASIC uses Level III and adds several additional commands and statements of its own. In addition to commands that give it access to the disk, it offers additional options for adding your own BASIC or machine-language functions to a program, improved string handling, and special functions. The latter protect programs from interruption, sort lists numerically or alphabetically, pack your programs more tightly to take up less memory, and look through your programs to see where you've used various commands or statements.

Both Disk BASIC and TRSDOS, the Disk Operating System, have provisions to duplicate on the printer all output sent to the screen and to keep track of the time and date. TRSDOS also has error messages to explain problems that are usually your fault, like looking for a program not on the disk you've loaded, leaving the disk drive open, or stating commands incorrectly. For the latter problem a HELP command tells you how most commands should be stated. Also included are programs to read and correct programs and data files plus the usual "utilities" to copy disks and programs, read the directory, and so on.

Input and Output. The Model III has six input/output systems: the keyboard and video display for interaction with the user, the cassette port, the optional disk system, the line-printer port, the optional serial port, and an "extension bus" connector. All are in various ways improvements on those of the Model I.

The first differences most users note are in the keyboard and display. Whereas the Model I's keyboard had a slightly spongy feel, which made it difficult to tell when a keystroke was completed, the Model III's works with a lighter touch and has a more definite "bottom," which makes operation faster and easier. The new keyboard works by sensing changes in capacitance as keys are pressed rather than by mechanical switch contacts. This makes the new keyboard apparently immune to keybounce (a problem for many Model I users) and more reliable. The display is considerably sharper than the Model I's, something you appreciate when you've been working at the computer all day.

Almost equally important—and even more improved—are the provisions for loading and saving programs and data on cassette or disk. Without such "mass storage" long programs become impractical. In the time it takes to type in a long mathematical program (for example) and edit out typing errors, you could long since have solved the problem with pencil and paper; in the time it takes to type in a game program, your fellow players will have lost interest and probably gone home.

Like the Model I, the Model III can be used with just about any decent audio-cassette deck or recorder with a "line"-level input and adjustable output level. (The recorder's output level must be exactly right or programs won't load properly. And the on-screen loading indications only help you find the right level when you're almost there, so you may be better off buying Radio Shack's \$60 CTR-80A for which output-level-setting instructions are provided with the programs.) There are three improvements here: the level setting is far less critical when loading tapes into the Model III, loading is generally more reliable, and you can load and save tapes not only at 500 baud (the Model I's

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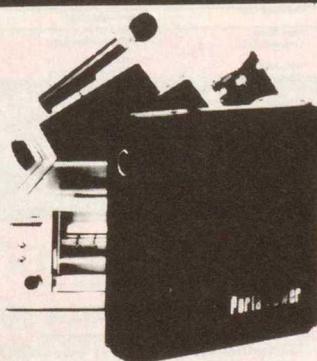
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Level II speed) but at a breezy 1500 baud as well.

The differences in the disk system are equally significant. The main one is that these new disks are "double-density," which means they hold about twice as much as Model I disks did (175K vs. about 77K bytes) and load faster. The extra capacity gives the convenience of more programs or files per disk. It's also a major economy: we have 60 disks full of programs and files on the Model III, which would take us 136 disks (at \$3 each) if the Model I were our main machine.

When the Model I came out there were few high-quality printers available at prices the hobbyist would pay, so it made sense to make the "port" to which the printer was connected part of the accessory Expansion Interface. The Model III has its printer port built in at no extra cost, and even Level I BASIC can now output through it, while any program running under Disk BASIC or TRSDOS can be made to send anything being displayed on the screen to the printer.

The printer port is a "Centronics parallel" type, which means it uses a separate wire to carry each of the eight bits in each character sent to the printer. There's also an optional "RS-232 serial" port (\$199), so-called because its data bits are sent serially, one after the other, down the same wire (other wires are used for control signals). The serial port can be used for output to printers with serial interfaces (the preferred connection when computer and printer must be far apart) and for communication with other computers. Such communications are usually through "modems," which change digital data pulses into tones for transmission over telephone wires. Most commercial modems are designed to connect to RS-232 serial interfaces, though Radio Shack and others do make modems that can be connected to TRS-80s without serial ports.

The extension bus gives direct electrical connection with the main signal paths inside the computer. So far we have heard of no devices designed to plug into it, but it does leave open possibilities of future expansion into almost anything. One good possibility would be a "hard disk" system which could hold far more data than floppy disks.

Software Availability. There are probably more programs available for the TRS-80 Model I than for any other small computer, so the Model III was designed to be compatible with Model I software. "About 95 percent" of Model I software will run on the Model III, according to Radio Shack, though that's more true of games and similar programs than more elaborate ones for serious applications such as business.

Of the 55 cassette and 38 disk programs listed in the newest Radio Shack computer catalog, 52 tape and 25 disk programs are available for both models, while two tape and eight disk programs are for the Model I exclusively, one tape and five disk programs for the III alone. Most of the Model-I-only programs will eventually be reissued in forms suitable for the Model III; the odds are that programs written for the III alone will not appear in versions suitable for the I.

Graphics. The Model III has the same graphics that the Model I had: a set of 64 graphics "characters" which can be put together in 48 rows of 128 characters apiece to make pictures on the screen. Since each character is made of six small rectangles in a two-by-three array, you effectively control a field of 144 by 256 rectangles, or 36,864 spots.

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all told. That's almost a match for the new TRS-80 Color Computer (VIDEO, August 1981) which can put up to 192 by 256 picture elements on screen.

With its new, sharper video display, we think the Model III could have been given finer graphics resolution than the Model I. But it wasn't—probably to maintain compatibility with the vast array of Model I software. This was a sensible decision, but we wish there were room in the system for an alternate higher-resolution graphics mode.

Conclusion. When the FCC's new interference requirements forced Radio Shack to replace the Model I, the company didn't merely fulfill those requirements. It re-engineered the product to improve it as much as possible in ways that user experience had dictated. To have re-engineered it further would have reduced its ability to use the large pool of Model I software already available. And though the improvements reduced that compatibility a little, the results of the improvements were well worth it.



**Test Report: Radio Shack
 TRS-80 Model III Computer**

DATA

Date of test: October 1981

Microprocessor: Z-80

Programmed system memory (ROM): 4K Level I BASIC, upgradable to 4K Model III BASIC. One K equals 1024 x 8 bits.

User Memory (RAM): 4K internally expandable to 16K, 32K, or 48K

Languages: Level I BASIC, Model III BASIC, or Disk BASIC

Input/Output (I/O): built-in keyboard and display, one built-in cassette interface with computer-controlled 500/1500 baud rate for Model III and 250 baud for Level I, parallel printer interface (Centronics-type), and buffered Model III bus. Optional RS-232-C interface and disk interface for up to four 5 1/4-inch drives is also available at purchase or as later addition. All interfaces are internal.

Keyboard: 65-key capacitance-type keyboard including separate 12-key numeric keypad. The reset button at the extreme right of the keyboard is not counted.

Display: built-in 12-inch video display includes 96 text characters, 64 graphics characters, and 160 special characters. Screen format is 64 characters by 16 lines with Model III BASIC permitting a double-sized format of 32 characters by 16 lines. Model III BASIC allows upper- and lower-case characters and repeating keys.

Dimensions: 12 1/2 x 18 1/8 x 21 1/2 inches (h/w/d)

Power requirements: 105-130VAC, 60Hz. Wattage dependent on options

Price: \$699 with 4K RAM, Level I BASIC (options extra); \$999 with 16K RAM, Model III BASIC (options extra)

Peripherals and accessories: cassette recorder, disk drives, modem, printers, appliance controllers, desks, dust covers, supplies, etc.

Software: An extremely wide selection is available from Radio Shack and from others. RS software is listed in its many catalogs. It also publishes a book, updated at intervals, that lists software from other suppliers. Programs exist in all categories including educational, personal, business, programming, and games.

RESULTS & RATINGS

Graphics: good

Keyboard: excellent

BASIC: Level I—fair; Model III—good/very good; Disk—very good/excellent

Manuals: very good (Radio Shack)

Software: Radio Shack good/very good; other suppliers from poor to excellent